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THE SEISMOELECTRIC EFFECT OF THE FIRST KIND (J)  
IN A REGION NEAR ELECTRODES

A. G. Ivanov

The author suggested in 1940 that seismoelectric effects be divided into two types: (1) the seismoelectric effect of the first type (J), being a change in the current passing through the earth from electrodes during percussions; and (2) the seismoelectric effect of the second type (E), being the generation of differences of electric potentials in rocks under the action of seismic oscillations. This effect was first discovered and studied in the work of the Geophysics Institute, Academy of Sciences, from 1938 to 1940. In studying the effect of the first type, it had been noted that the sensitivity to elastic oscillations in the earth of the regions close to electrodes of opposite sign is quite different.

In this experiment, two copper electrodes 400 millimeters long and 35 millimeters wide were driven into the earth and connected to a battery, transformer, and galvanometer. A current of 0.36 ampere was passed through them from the battery. A weight of 32 kilograms was then dropped from a height of about 2 meters at a distance of 2.2 meters from one of the electrodes. The current variations which occurred due to the elastic oscillations of the earth were recorded by a short-period galvanometer on the phototape of an oscillograph. The electrode closest to the point of impact could be made either a cathode or anode by simply changing the direction of current in the circuit. It turned out that the effect of the percussions upon the current strength in the region of earth close to the anode was approximately eight times greater than in the region of the cathode. This result was checked repeatedly for percussions at various distances from the electrode both visually and by the oscillograph method. The dependence of amplitude upon the force of impact (for constant current) and upon current strength in the circuit (for constant force of impact) were also determined.

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Laboratory experiments were conducted on sand of average moisture content to check this higher anode sensitivity to percussions near the electrode region. Tests were conducted to disprove the possibility that the percussions broke up poorly conducting zones which had formed on the surface of the electrode itself when current was passing through it.

In attempting to explain the physical nature of the phenomenon, the author concludes that during the action of percussion upon the regions of earth near the electrode finely dispersed rock particles resting in this region are stirred up and at this moment the permeability of the rocks is increased and resistance of the circuit decreased. This preliminary explanation is corroborated by the fact that in 1936 V. A. Marinin, while studying the electroconductivity of rocks, established that a poorly conducting layer of considerable thickness forms in the anode region when a direct current is passed through rock samples. This must have been due to the accumulation in the pores of the rock of finely dispersed particles which were carried by the current. These phenomena are not observed near the cathode, which is probably explained by the predominance of negatively charged colloidal particles.

This peculiarity of the seismoelectric effect of the first type in the region near the electrode is of interest not only in the study of seismoelectric effects under natural conditions and in studying the nature of the electrical conductivity of rocks, but may also find practical application in the development of core-sampling methods in drill holes with drive pipes.

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